LOPATA TECHNICAL SERVICE CORP.
E-Mail: lopatatechservice@ameritech.net

December 3, 2004

Mr. Ernest W. Brix, Jr.
President
Industrial Environmental Management Consultants, Inc.
804 Wabash Avenue
Chesterton , IN 46304

(219) 929-4487
FAX (219) 929-4105
E-Mail: Ernest.Brix@IEMC1.com

US STEEL / GARY WORKS
#13 BLAST FURNACE CAST HOUSE
POTENTIAL EMISSIONS CONTROL SYSTEM
FOR SULFUR DIOXIDE

Dear Ernie:

Thank you for your call earlier today ... asking me to review the information that we discussed in the July / August , 2004 time-frame concerning possible modifications to the current particulate (PM_{10}) air emissions control system on the Number 13 Blast Furnace Cast House (Caster) at US Steel / Gary Works.

As we discussed, the original PM_{10} system was installed by Wheelabrator Air Pollution Control, Inc. of Pittsburgh , PA under a contract with Eichleay Engineers (Wheelabrator Contract Number 20-3387) in the 1993 / 94 time frame. I was the Wheelabrator representative at that time and am still the "local representative" for Wheelabrator Air Pollution Control, Inc. and Wheelabrator Canada Company.

The original installation at the #13 Blast Furnace Cast House (Caster) includes a mass cooler to control the temperature of the particulate laden gases going into the baghouse followed by a dust collector / baghouse to control the particulate. The mass cooler works by convective heat transfer from the hot air stream to a series of heavy / massive steel plates that are spaced fairly close together. The plates store heat energy until the casting operation is completed. When the casting is completed, cool air is passed over the plates – cooling the plates, again, by convection. The mass of the plates controls spikes in temperature and protects the baghouse from temperature upsets and spark / fires that could render it useless. The mass cooler is necessary to the proper operation of the fourteen-module Wheelabrator JET III Model 1918-TA-(SB)-168-6P baghouse that controls the particulate emissions from the caster operations.

1130 NORTH DEARBORN STREET SUITE 1702 CHICAGO, ILLINOIS 60610 (312) 280-1574 FAX (312) 951-0484

During our discussions in July / August , 2004: you asked about controlling the sulfur dioxide (SO_2) emissions from the #13 Blast Furnace Cast House (Caster). I reviewed this application with the Vice President of Technology for Wheelabrator Air Pollution Control, Inc. We discussed the possible use of lime injection systems (such as Spray Dryer / Absorber or Dry Sorbent Reactors) to reduce the SO_2 .

In terms of acid gas reduction, the best performance would be at high temperatures (in front of the mass cooler) – using a Spray Dryer / Absorber. The high temperature (typically in the 350-400° F range) evaporates the excess water in a lime slurry and dries the lime slurry to lime particulate. This spray drying cools the air stream and does an excellent job of neutralizing acid gases such as sulfur dioxide. Unfortunately, injecting large amounts of lime in front of the mass cooler plates (whether in a Spray Dryer / Absorber or a Dry Sorbent Reactor) would probably result in plugging the spaces between the plates and rendering the mass cooler useless as well as stopping the air flow to the baghouse. This is not acceptable, and is not recommended.

The suggested "solution" to remove sulfur dioxide (SO_2) from the target air stream is to put a lime injection system behind the mass cooler — in front of the dust collector / baghouse. At this point in the system, the temperature of the target air stream is fairly well controlled by the mass cooler at about 250° F – which is too low for a Spray Dryer / Absorber to function properly.

The most efficient method to remove sulfur dioxide (SO_2) from the target air stream at 250° F would be to use a Dry Sorbent Reactor. The estimated size of this Dry Sorbent Reactor would be a tower about 22-feet in diameter X about 120-feet tall. Unfortunately, this reaction tower will not fit into the space available at the #13 Caster at US Steel / Gary Works ... so it cannot realistically be considered further.

The next most efficient system would be to use direct lime injection into the ductwork. For a "normal" dry lime injection system, the lime is typically injected into the ductwork at a location where there would be enough reaction time and adequate mixing to accomplish a reasonably high acid gas (SO_2) removal efficiency. With the very short run of ductwork between the mass cooler and the existing baghouse: Wheelabrator Air Pollution Control, Inc. is very doubtful that good mixing of the lime reagent and the SO_2 laden air stream can be achieved or that adequate reaction time can be provided to achieve a reasonably high removal efficiency ... but this is about the only system that can be fit into the available space and that will not upset the other processes that are controlling other target pollutants. The budgetary cost for this dry lime injection system (injection nozzle grid, air conveying system, lime storage silo) is about $ 500,000.

At the relatively low temperature behind the mass cooler (250° F), the technical staff at Wheelabrator Air Pollution Control, Inc. has estimated that the best SO_2 removal efficiency that can be achieved is on the order of only 40%. This means that the current emissions level of about 125 pounds per hour of sulfur-dioxide will be reduced to about 75 pounds per hour. In order to achieve this 40% reduction in SO_2 , (because of the relatively low temperature of the target gas stream) US Steel / Gary Works will need to inject somewhere between 1,000 and 2,000 pounds per hour of lime into the ductwork between the mass cooler and the existing Wheelabrator baghouse. At the current cost for lime of about $ 100 per ton, this is an additional operating cost

on the order of $50 - $100 per hour plus utility and maintenance costs for a reduction of about 50 pounds per hour of SO_2 .

Considering the high capital and operating costs for a relatively low removal efficiency of sulfur dioxide, I think that this project is highly questionably. If, however, US Steel / Gary Works finds that these costs can be justified, please call me and I can arrange for Wheelabrator Air Pollution Control, Inc. to provide firm quotations on either the supply of the equipment (only) or on the supply and installation of the equipment. Please call me if you have any questions, or if I can be of further assistance on this potential project.

Jim Lopata

Jim Lopata
Lopata Technical Service Corporation
Representing Wheelabrator Air Pollution Control, Inc.